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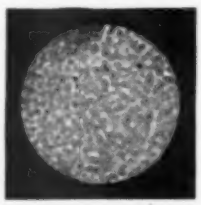

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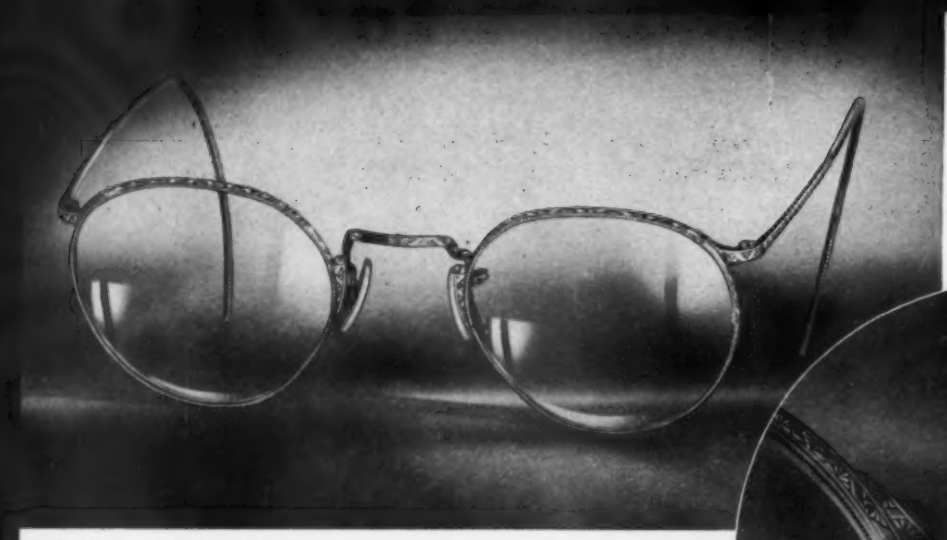

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AMERICAN JOURNAL OF OPTOMETRY

Vol. 14 MARCH, 1937 No. 3

NOTES ON THE RELATION BETWEEN READING DIFFICULTIES AND VISUAL ABNORMALITIES*

J. G. Goodsell, M.A., Opt.D.
Los Angeles, Calif.

In answering the question, "Do poor readers have visual defects?" most of us would hazard an answer in the affirmative. What do statistics and surveys show? Mr. L. P. Farris, Principal of Oakland High School reports the following findings based upon a visual survey made in the Oakland Public Schools:[1]

(a) Forty-four per cent., i.e., 739 of the 1685 pupils who were given the visual tests were found to have eye defects of varying degrees.

(b) Both hyperopia and strabismus are associated with less than normal progress in reading; while myopia and myopic astigmatism were both found to be associated with more than normal progress.

(c) Pupils whose visual perception is monocular make progress in reading superior to those not having correct coordination of the two eyes.

(d) Types of eye defects other than the myopic, hyperopic and strabismic types have little effect upon progress in reading. In other words, the data of this study do not bear out the hypothesis that children with defects in visual acuity regardless of type are always handicapped with respect to the learning of reading.

(e) The generally accepted standard of eye structure (emmetropia) does not necessarily imply superiority of efficiency in reading.

From another source of information we find even greater doubts as to the correlation between eye-defects and reading ability. Paul A. Witty and David Kopel, director and assistant director of the Northwestern University Psycho-educational Clinic make the following statement:[2]

---

*Submitted for publication Feb. 5, 1937.

1. Farris, L. P., Visual Defects, Sierra Educational News, September, 1936.
2. Witty, Paul A. and Kopel, David: Heterophoria and Reading Disability, Journal of Educational Psychology, March, 1936.

Are visual defects, then, unassociated with reading achievement? The answer, predicated upon the group analyses above, is not an unequivocal "yes." True it is, that the visual defects are not etiologically concerned in poor reading, one should recognize this alternative: Visual defects may impede the reading progress both of poor and of good readers. In other words, it is suggested that although the relative incidence of various visual defects among poor readers does not distinguish them from good readers, visual defects are not necessarily unrelated to reading achievement: *Correction of defects may improve the reading ability of poor readers and of those who exhibit no reading difficulties.*

The writer has had an opportunity to make a survey of some high school students in one of the large schools in the city of Los Angeles. Two groups were examined, one a normal 10th grade English class and the other a group of about the same size, the members of which form a class needing instruction in reading. The form shown below was used in the survey omitting the phoria (at 40 cm.) and the Ishihara color tests.

Last Name			First Name			Birth Date	
History							
Snellen Acuity	Without	R	O.U. 20/		O.D. 20/	O.S. 20/	
	With	R	O.U. 20/		O.D. 20/	O.S. 20/	
Red Glass (20 ft.)		(S. Binocular)			(Diplopia)	(Monocular R.L.)	
Phoria (40 can.)		(	Exo.)	(	Eso.)	(Monocular V.)	
Retinoscope (Static)		O.D. (Low)	(Med.)	(High)	(Hy.)	(My.)	(As.)
		O.S. (Low)	(Med.)	(High)	(Hy.)	(My.)	(As.)
Color Vision (Ishihara)		(Neg.)		(Pos. #S O			)
Stereoscope (Line & Dot)		—O—		———		——— O	
	(Arrow & Figures)						
	(Circles & 3 Lines)						
Hale	C_2		E_1				

Some of the data gathered is given below and may be of interest:

	Normal Group	Remedial Reading Group
Average age (months)	198.24	213.37
Average Reading Grade	8.41	6.18
Average Intelligence quotient	97.00	87.00
Average Muscle balance at near through stereoscope	7.00	5.80

It should be noted that the poor readers on the average are older therefore retarded one and one quarter years compared to the "normal" group while as far as reading ability is concerned they are retarded about two and one-third years of school grade.

The intelligence quotient is not so significant when one realizes that intelligence tests are largely reading tests and therefore naturally would follow the findings of the tests designed to check up on reading ability. The most significant fact shown in the above data seems to be the muscle balance which was obtained by use of a slide, consisting of an arrow and numbers, viewed through the stereoscope. The normal eyes fuse the two sides of the slide so that the arrow points to approximately the figure 7. Notice in the above results the average for the poor readers, in the test, was 5.8. This seems to indicate a poor or low degree of convergence. Is this a cause or a result?

These facts make us realize the great need of giving these unfortunates all of the help possible. It is undoubtedly true that the causes of poor reading ability are not simple and of a uniform nature in every case. In fact some one has segregated the causes of poor reading ability into the following divisions:

1. Causes due to original nature.
   (This includes intelligence, eye and speech defects, etc.)
2. Causes due to environmental conditions.
   (Foreign language and poor educational opportunities.)
3. Causes due to poor teaching. . .
   (Over emphasis upon oral reading, phonetics, etc.)
4. Accidental causes.
   (Transfer from one school to another, illness, absence, etc.)

It is the writer's belief, however, that much more can be learned about the muscle balance of the two eyes when used at the reading distance. Also the brain pattern and brain habits which are in use under such conditions is something we know little about. Perhaps much may be learned by the use of further tests and research in this direction.

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LOS ANGELES SCHOOL OF OPTOMETRY
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LOS ANGELES, CALIF.

COLORED MIRAL REFLEXES AND A SUGGESTION FOR STUDYING THESE REFLEXES BY MODIFYING THE KERATOMETER*

F. McFadden, Opt.D.
Rutland, Vermont

A recent article by Dr. James H. Drakeford[1] discusses the miral reflex of the cornea when the curvatures are being taken with the keratometer. He speaks of a reddish hue to which he ascribes certain pathological conditions, also the clear neutral reflex shading off to yellowish and other tints. The instrument used is the Sutcliff, which as we well know, is the forerunner of the present Bausch & Lomb instrument. Subsequent observations were made with the General Optical instrument the Universal Opthalmometer. The author quoted requests that others who have made observations should continue these and describe what they have seen.

Several years ago the writer observed certain peculiarities of the corneal reflexes while using the C. I. instrument and wrote on this subject at that time, in the KEYSTONE MAGAZINE OF OPTOMETRY. It was then observed that certain patients exhibited the marked reddish-yellow corneal glow while that from others was of a whitish or silvery, or a steeley-blue characteristic. These colors were particularly apparent when the Mires of the instrument were in sharp focus but under the impulse of either carelessness or curiosity the instrument was racked forward and back beyond the useful reading stage for corneal measurements upon a purely experimental, exploratory expedition just to see what change it might make in the corneal colors. A number of these cases which showed a marked orange-red reflex exhibited a peculiar condition when the instrument was racked back from 4/16 to 5/16 of an inch.

When racked back to this approximate position the epithelial layer of the cornea is clearly seen, often having a roughened orange-peel appearance not at all like that of a polished glass surface. At times these people have shown a rather sticky tectile sebaceous fluid which appears to lay in narrow vertical windrows, immediately after a wink, this

*Submitted for publication Jan. 21, 1937.
1. January issue, 1937. American Journal of Optometry.

surface gradually flattening out until the next wink clears, this mass gives the impression of stringiness. When such a patient is questioned as to the feeling of their eyes, with reference to the lids, they sometimes remark that they smart, itch, and burn, or have other symptoms of slight discomfort. The fact that highway dust is at times observable upon the anterior surface of such corneas when the patient has ridden some distance over a dusty road has at times had an amusing angle. When asked if they had encountered much dust on the way to my office they often would reply "how could you guess that?"

The background for observation of this abnormal corneal surface condition is the relatively large surface of the two central CC's of the C. I. instrument. The mires of the General Optical instrument, for some reason the writer has never understood, would not show these conditions whether the instrument was racked back or was pre-focused. Curious as to the areas involved, but limited by the narrowness of the band of the CC and the impossibility of bringing them to the central field, the writer removed the central tube of the instrument, procured a pint tin dish, inside of which was placed two powerful lights connected with the switch of the instrument, covered the frontal open surface of the dish with a transparent sheet of pure white paper, the entire business pierced in the center to allow observation. The area of this basin was that of a 6-inch dish. With this rebuilt instrument several patients, who had formerly shown this peculiarity of corneal reflex, were studied, and these conditions could be quite readily seen. It is suggested that others follow up this manner of investigation which now seems to have more meaning than it did fifteen years ago.

I might also suggest that optometrists wishing to engage in some independent office investigation of this rather interesting corneal reflex problem might procure a used C. I. keratometer and make the suggested changes in it keeping it on hand to use on these cases. The older models of this instrument can, as a rule, be had for but little expense, and by so doing, each case could be studied without interfering with ordinary examination routine.

DR. F. MC FADDEN
RUTLAND, VERMONT

SEQUEL TO CASE REPORT OF A LOW FATIGUE TOLERANCE IN THE ADDUCTION*

Israel Dvorine, O.D.
Baltimore, Md.

In the November issue of 1936, I reported in this Journal the history and examination procedure of a patient who was referred by a psychiatrist for an analysis of her visual problem.

To sum up briefly what has been reported previously, the patient complained that during the past three years she has been having pain in and about her eyes, occipital headaches, photophobia and inability to read for any length of time with or without her glasses. During this period she was refracted twice and glasses were prescribed each time. She was advised to exercise her eyes by means of "finger to the nose" and lately she was told that she may need an operation on her eye muscles.

An analysis of her visual reflexes revealed that the patient presented a typical C-ONE type problem, which has been defined as an individual with a lowered threshold of fatigue tolerance in the somatic nervous system than in the autonomic system, producing an interference in their association in the visual reflex. Especially significant was the fact that the No. 13 finding showed 4△ of Exophoria without glasses and 14△ of Exophoria with old correction.

The immediate correction prescribed, following the examination, was a pair of plus .50 spheres, O.U. for reading only. This was done for the psychic effect on the patient who felt that she could hardly get along without glasses; and because she was bordering on presbyopia. Another factor was the need to recondition her visual reflex so that plus lenses would be tolerated without reflexly inhibiting the adduction. The above correction was selected for that purpose.

The orthoptic procedure was as follows: During the first month patient came to the office three times a week for half-hour periods; second month, twice a week, and the last few weeks once a week. In addition to the office treatments, patient was instructed to practice at home, not less than 30 minutes a day with a special set of reading charts used with a hand stereoscope. The charts were made as follows:

*Submitted for publication Feb. 6, 1937.

MOTHER, GIRL, 5, INJURED IN CRASH

Mrs. June Biegal, 38, 1501 Second street N.E., and her five-year-'d daughter, Joyce, were injured collision at W. Broadway ave-ear First street Friday night. ... 'gal was taken to Swedish hos... 'ere her condition today was r... as fair.

Accor... the police report, a car driven ...seph Biegal, 39, was struck ... automobile of Morgan Bowen, ...704 Central avenue, which ski... ...ut of control.

M... ...ER, GIRL, 5, IN... ...ED IN CRASH

Mrs. Ju... ...gal, 38, 1501 Second street N. ...d her five-year-old daughter, ... were injured in a collision at ... ...adway avenue near First stree... ...ay night. Mrs. Biegal was take... ...wedish hospital where her cond... ...nday was reported as fair.

According to the police re... car driven by Joseph Biegal, was struck by the automobile ... Morgan Bowen, 52, 2704 Central avenue, which skidded out of control.

Figure One

Having secured duplicate newspapers, duplicate articles were cut out, one column in width and about 2½ inches in length. These clippings

LOAN SHARK LAW PROSPECTS FADE

Lo... ...rk legislation today had been ...lly killed as a result of actio... ...n by the house public welfa... ...mmittee late Friday, when ...mended the small loan bill t... ...ibit charging of interest of m... ...n 8 per cent.

Re... ...ative F. L. Palarine (L), ...ul, author of the original ... protested vigorously again... amendment. The original b... ...posed to permit charging of ... ...est on loans up to $300 at 2½ ...cent a month.

Pal... declared he will oppose the bi... the floor.

LOAN SHARK LAW PROSPECTS FADE

Loan shark legislatic ...ay had been virtually killed a... ...sult of action taken by the ... public welfare committee ... Friday, when it amended the ... ll loan bill to prohibit chargin... ...nterest of more than 8 per ce...

Representative F. ... 'alarine (L), St. Paul, author ...e original bill, protested ...orously against the amendmen... ...e original bill proposed to p... charging of interest on loan... to $300 at 2½ per cent a mo...

Palarine declared he ... oppose the bill on the floor.

Figure Two

were pasted on cards which were of the size commonly used in a stereoscope. Small strips of gummed paper were then pasted at various angles across the printing matter to make certain that she was using both eyes simultaneously during the exercise. See figures 1 and 2. Since the key charts of the Dvorine Fusion Set showed that her easiest fusion distance was 8 cm. separation, the clippings were arranged so that the distance between their centers was no more than 8 cm., and a few were less than that.

In addition to the charts, the patient was furnished with treatment glasses in which were mounted a pair of minus .50 Spheres and with a slip-over front in which were mounted O.U. 2△ prisms bases-out. These prisms (ground on six base curve) were used in conjunction with the minus lenses and the slip-over front made it possible to increase the prism power, from time to time, independent of the lens correction used for exercising purposes.

The following changes were made in the glasses:

1st	pair.....	Minus .50 Sph.	and	4△ Base Out
2nd	pair.....	Minus .50 Sph.	and	6△ Base Out
3rd	pair.....	Plano	and	4△ Base Out
4th	pair.....	Plano	and	8△ Base Out
5th	pair.....	Plano	and	12△ Base Out
6th	pair.....	Plano	and	16△ Base Out
7th	pair.....	Plus .50 Sph.	and	12△ Base Out
8th	pair.....	Plus .75 Sph.	and	12△ Base Out
9th	pair.....	Plus 1.00 Sph.	and	12△ Base Out

Office procedure consisted of rotational exercises using the myoculator, monocular excursions at first, then binocular; fusion training with stereoscopic charts and the building up of adductions with prisms base-out. After each training period a record was made of the progress and instructions were given to the patient regarding home exercises.

Within three weeks, patient reported that she was feeling much better and that she was able to do her school work with some degree of comfort. The photophobia gradually decreased and, as tolerance for light increased, she finally discarded the smoked glasses entirely. After twelve weeks of orthoptics all symptoms of discomfort were gone. A re-examination of her visual reflexes resulted in the following:

(For comparative study, the results of the first examination, prior to the reconditioning, are here given as well as those of the final examination.)

UNCORRECTED VISION:

First Examination:
O.D. 100%; O.S. 100%; O.U. 100%
Fixation at 16 inches O.U. 100%

Final Examination:
O.D. 100%; O.S. 100%; O.U. 100%
Fixation at 16 inches O.U. 80%

2. OPHTHALMOMETER:

First Examination:
No Astigmia.

Final Examination:
No Astigmia.

3. HABITUAL PHORIA AT FAR POINT:

First Examination:
Without lenses: 4△ Exophoria. 1△ Left Hyperphoria.

Final Examination:
Without lenses: 1△ Esophoria. No Hyperphoria.

4. STATIC RETINOSCOPY:

First Examination:
O.D. Plano . O.S. Plano.

Final Examination:
O.D. Plano . O.S. Plano.

5. DYNAMIC RETINOSCOPY:

First Examination:
At 20 in.: O.D. Plus 2.00 D.Ph.; O.S. Plus 2.00 D.Sph.

Final Examination:
At 20 in.: O.D. Plus 1.25 D.Sph.; O.S. Plus 1.25 D.Sph.

6. DYNAMIC RETINOSCOPY:

First Examination:
At 40 in.: O.D. Plus 1.25 D.Sph.; O.S. Plus 1.25 D.Sph.

Final Examination:
At 40 in.: O.D. Plus .75 D.Sph.; O.S. Plus .75 D.Sph.

7. SUBJECTIVE:

First Examination:
O.D. Plus .25 D.Sph. Vision 100%.
O.S. Plus .25 D.Sph. Vision 100%.

Final Examination:
O.D. Plus .25 D.Sph. Vision 100%.
O.S. Plano Vision 100%.

8. PHORIA AT FAR POINT WITH NEW RX.

First Examination:
4△ Exophoria.

Final Examination:
1△ Esophoria

9. TRUE ADDUCTION:

First Examination:
(?)

Final Examination:
14△

10. CONVERGENCE AT FAR POINT:

First Examination:
Break 20△, Recovery 9△.

Final Examination:
Break 28△, Recovery 20△.

11. ABDUCTION AT FAR POINT:

First Examination:
Break 13△, Recovery 9△.

Final Examination:
Break 12△, Recovery 11△.

12. VERTICAL PHORIA:

First Examination:
1/2△ Left Hyperphoria. Ductions Sur. 4△/2△.
Inf. 4△/2△.

Final Examination:
No Hyperphoria. Ductions Sur. 4△/3△. Inf. 3△/2△.

13A. PHORIA AT 16 INCHES:

First Examination:
Without lenses: 4△ Exophoria.
With Old Rx. 14△ Exophoria.

Final Examination:
Without lenses: 1△ Esophoria to 2△ Exophoria.
With plus 1.00; 5△ Exophoria.

13B. NEAR PHORIA WITH SUBJECTIVE:

First Examination:
7△ Exophoria.

Final Examination:
3△ Exophoria.

14A. INHIBITION OF ACCOMMODATION UNDER DISASSOCIATION:

First Examination:
O.U. Plus 1.25 D.Sph. Gross.

Final Examination:
O.D. Plus 1.25 D.Sph.; O.S. Plus 1.00 D.Sph. Gross.

14B. INHIBITION OF ACCOMMODATION WITH ADDUCTION FIXED:

First Examination:
O.U. Plus 1.50 D.Sph. Gross.

Final Examination:
O.D. Plus 1.00 D.Sph.; O.S. Plus .75 D.Sph. Gross.

15A. INHIBITION OF ADDUCTION WITH ABOVE:

First Examination:
14△ Exophoria.

Final Examination:
5△ Exophoria.

15B. INHIBITION OF ADDUCTION WITH ABOVE:

First Examination:
14△ Exophoria.

Final Examination:
5△ Exophoria.

16A. ACCOMMODATIVE TOLERANCE OF ADDUCTIVE STIMULATION:

First Examination:
22 prism diopters.

Final Examination:
28 prism diopters.

16B. MAXIMUM ADDUCTIVE STIMULATION:

First Examination:
Break 22△, Recovery 16△.

Final Examination:
Break 30△, Recovery 8△.

17A. ACCOMMODATIVE TOLERANCE OF ADDUCTIVE INHIBITION:

First Examination:
20 prism diopters.

Final Examination:
28 prism diopters.

17B. MAXIMUM ADDUCTIVE INHIBITION:

First Examination:
Break 30△, Recovery 20△.

Final Examination:
Break 32△, Recovery 22△.

18. VERTICAL PHORIA AT NEAR:

First Examination:
1/2△ Left Hyperphoria. Ductions Supr. 5△/3△, Inf. 5△/3△.

Final Examination:
No Hyperphoria. Ductions Supr. 6△/3△, Inf. 6△/4△.

19. AMPLITUDE OF ACCOMMODATION:

First Examination:
O.D. 5 Diopters; O.S. 5 Diopters; O.U. 5 Diopters.

Final Examination:
O.D. 4 Diopters; O.S. 4 Diopters; O.U. 4 Diopters.

20. TOLERANCE OF ACCOMMODATIVE STIMULATION WITHOUT ADDUCTIVE RESPONSE:

First Examination:
O.U. Minus 1.00 D.Sph.

Final Examination:
O.U. Minus 1.25 D.Sph.

21. TOLERANCE OF ACCOMMODATIVE STIMULATION WITHOUT ADDUCTIVE RESPONSE:

First Examination:
O.U. Plus 3.00 D.Sph.

Final Examination:
O.U. Plus 2.25 D.Sph.

FUSIONAL ABILITY:

First Examination:
"Examination of fusional ability, using Dvorine charts, shows Key chart A1, ball over Fig. 8 and moving toward 9. Fuses charts of the C group having 9 and 8 cm. separation; with tendency to diplopia when using chart with 7 cm. separation and definite diplopia with 6 cm. separation. Tests for refinement of fusion, using E group, shows an intermittent suspenopsia of the left eye."

Final Examination:
Key chart A1 shows ball between figures 8 and 7 and moving toward 6. Fuses charts of the C group having 9 cm., 8 cm., 7 cm., 6 cm., 5 cm., 4 cm. and 3 cm. separations. Tests for refinement of fusion using E group shows no suspenopsia and can hold fusion with 20△ prisms base out.

DISCUSSION:

A careful review of the findings of the first and final examinations clearly indicates that the visual reflex of this patient has been reconditioned. The prognosis made in November that,

> "This patient must be able to tolerate plus lenses at near without reflexly inhibiting her adduction to the extent that she does at present. She must develop a normal play between the functions of accommodation and adduction and show an equal ratio of inhibition in No. 14A and No. 15A test,"

is now a demonstrable fact evident in findings Nos. 9, 13B, 14A, 15A, 14B and 15B. There was a slight loss in the No. 19, amplitude of accommodation, which may have been prevented with monocular minus lens exercises, but the amplitude at present is not lower than the expected for the age of the patient (44 years). An Rx of Plano for distance with an Add of plus 1.00 for near will fully compensate for the loss.

SUMMARY

1. A case history of a patient is herein presented showing symptoms of a low fatigue tolerance in the adduction.

2. An outline is given of the procedure used to recondition the visual reflex of this patient.

3. Report of the final examination is offered for comparison with the first examination showing that normal relationship has been established in the accommodative-convergence reflex at the conclusion of 12 weeks of Orthoptics.

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SOME INTERESTING CASE REPORTS*

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Pseudo-Myopia

Patients suffering from this defect are not numerous, but the trouble must be definitely diagnosed as otherwise there is the danger of "locking" —by lenses—a vicious circle functional mal-adjustments. I will explain this by citing particulars of two cases.

CASE NO. 7308: Miss D.

This lady came to me originally in 1933 complaining of frontal headache *after* reading. Visual acuity 9/18 O.U. Retinoscopy showed.

O.U. +3.75 D.Sph.⌒ —0.50 D. Cyl. Axis: 180

Her symptoms suggested spasm and I instilled homatropine 2%. Subjectively she accepted +0.50, and with a binocular addition of 0.25 Sphere had the same acuity as without glasses, i.e., 9/18. O.U.

At the time I felt that the vision might improve when the ciliary had regained its tonus. I prescribed +0.75 Sphere and asked to see the patient later. Actually she did not call until October 5, 1936, when she complained of "blur" and orbital pains. Vision with her first prescription was now 9/36. Unfortunately, I did not see her myself on this occasion, but my colleague prescribed: O.U. —0.25 Sph. combined with a —1½° prism base-in, which gave 9/9. That set me thinking. For the first time ever, her acuity was 100%, but retinoscopy still showed plus—plenty! On the first of December I saw her myself by request and found the following prescription:

R.E. 9/18 —0.75 D. Sph.⌒ —0.25 D. Cyl. × 180. 9/9.
L.E. 9/24 —0.75 D.Sph.⌒ —0.25 D.Cyl. × 180. 9/9.

to which I added +0.25 binocularly, though it is doubtful whether she would truly have accepted it.

Status

Distance: 1 Eso. Near: 2 Exo.

With convergence fixed at 13":

Negative Accommodation: 2.00.
Positive Accommodation: 3.00.

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*Submitted for publication Feb. 2, 1937.

By this time I felt tolerably certain that I had a case of true pseudo-myopia. It has often been incorrectly called ciliary spasm, which is an entirely different thing. The myopia was increasing but when corrected the patient obtained 100% visual acuity.

As my readers realize, the more the individual tries to see, the more he or she would accommodate, and the more false myopia is produced. To break down this condition we must alter the convergence-accommodation relationship. The immediate aim, however, is to give clear and comfortable vision for distance and near work without putting any effort on the accommodation or convergence. In this particular case I gave divergence exercises on the synoptophore for a week and incorporated a +3.00 D. addition (it will be remembered that the positive accommodation was +3.00). In addition 2° prisms base-in each eye were incorporated, so that the prescription read as follows:

R.E. —0.75 D.Sph.⌒ —0.D.25 Cyl. × 180⌒2△ base in.
L.E. —0.75 D.Sph.⌒ —0.D.25 Cyl. × 180⌒2△ base in.
Add: O.U. +3.00 D.Sph.

After six treatments on the synoptophore, at the end of a fortnight the —0.75 Sphere could be omitted in order to get an easy 9/9! The case is not yet complete, but I fully expect to supply a plus correction shortly.

It might be argued that I should have used a drug to paralyze the ciliaries, but it will be remembered that on the occasion of the first visit three years ago, I did in fact do so.

My answer to such a question now would be: The use of a drug in cases of this kind is essentially a "medical" school approach which entirely neglects the functional aspect in cases of this type, for pseudo-myopia is a mal-function primarily due to the fact that convergence is negative with reference to accommodation, consequently, for a fixed convergence the eyes over-accommodate.

How much better is it to go to the root of the matter and re-educate the functions of accommodation and convergence—how much better to "drill" them to their correct proportions.

Myopia and Esophoria—the Explanation!

Here is another rather interesting report. The last examination was about three years ago, and it was ascertained from the patient that myopia had developed about ten years back. Here are the details.

CASE NO. 7299: Mrs. M.

Age: 56. Retinoscopy showed:

R.E. —4.50 D.Sphere.
L.E. —4.50 D.Sphere.

and the prescription based on subjective findings:

R.E. —5.50 D.Sph.⌒ —0.50 D.Cyl. Axis: 135.
L.E. —5.50 D.Sph.⌒ —0.50 D.Cyl. Axis: 135.

It was found impossible to take the distant phoria with any degree of accuracy owing to intermittent suspension but it appeared to be something over 20 prism diopters of esophoria. The status at near was 18 prism diopters of esophoria. In the above prescriptions I incorporated 2° prisms base-out, for distance and near, which added to the immediate comfort. I then started to investigate the cause of this unusual condition, and I found the left eye habitually suspended and swung in some 3 to 5 degrees on any occasion when the attention flagged, although the motility of the eye was perfect. The "mental effort" made when the attention was drawn to anything forced it to function on such occasions, and the eye would then abduct and see binocularly. When this happened fusion and stereopsis were perfect. As a first step I decided on stimulating exercises to force constant binocular vision with diverging or abduction treatment. Progress was very rapid indeed. For instance, on the second visit for orthoptic training the large ON NE slides in the synoptophore were achieved with the greatest difficulty owing to the habitual suspension, but after a while a limited range of fusion was developed; the next day, for example, a range of 12 prism diopters was achieved. A Dobson Amblyopia Reader was ordered and a clip-over made with a red glass in front of the non-suspending eye. The use of this combination would either force fusion or cause the opposite eye to suspend. This latter result I considered extremely unlikely. In practice the results hoped for were achieved and the patient can now very easily read the smallest type corresponding to 6/6 vision in the Reader. At the end of the exercises on the fifth visit I decided to take the phorias.

Distance: 10 Eso?
Near: 4 Eso.

Progress is continuing at the time of writing, and it is expected that a condition of orthophoria will be achieved for distant vision after a little more treatment.

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MYOPIA, ITS POSSIBLE CAUSE AND CARE*

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In the last two years, I have given considerable thought and attention to the noticeable increase in the number of myopic patients coming into my office, most of whom are school children, and office workers, whose visual demands required prolonged near point fixation.

I. Introduction:

Most of these people have no history of myopia in the family, and, usually, start out with a requirement of a relatively low minus lens correction. Their history usually discloses that they have had increased minus lens changes at periods ranging from three months to a year. Their satisfaction and comfort with their eye care is not absolute and can best be described by the statement that they were complacent rather than satisfied.

It seems rather reasonable to assume that their visual demands might have a bearing on their eye condition. At first it was assumed that possibly the present economic upset had something to do with the situation, but this wasn't entirely satisfactory, for, while this might explain some of the ocular problems among the adults, yet it would not explain the situation as far as the children were concerned. Further, it did not seem to be a justifiable assumption in the case of the office workers because on close questioning in the history, it was found that the condition was first experienced and noticed after several weeks' or months' work and always this work proved to be a very confining type of near point fixation.

I have no idea of presenting anything new, but rather to outline the procedure used in my office in handling this type of case. Credit for the original work and the inspiration on my part to do the work in my office is due Drs. Jaques, Spitler, Parkins, Luckiesh, and Skeffington. If what I have to present to you today has any merit, it must be based entirely on my application and interpretation of their work.

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*An abridgment of the material presented before The American Academy of Optometry at New York, N. Y., August 27, 1935.

II. References:

The writings and personal contact with Dr. Louis Jaques of Los Angeles, gave me the first inspiration to attempt to rationalize the handling of myopes. His work in the treatment of this type of case and his methods of diagnosis and case analysis have done much in contributing to what success I have had.

Dr. Riley Spitler, through his investigations of the supportive functions of the visual act, has helped me materially in understanding why many of my previous failures have occurred. His tehnique of treatment, I consider a most important factor in the satisfactory outcome of this type of work.

Dr. George A. Parkins of Ord, Nebraska, through his research and investigations in eye movements and their effect on reading speed, has been invaluable in handling the school child problem.

Dr. Matthew Luckiesh of Nela Park, in his research work which has established the effect of poor lighting on the eyes and on the human body in general, proves that a contributing factor in the increase of myopia, is the lighting in homes and offices, and shows rather conclusively that this factor must be considered and the lighting corrected, as one of the steps in caring for myopes.

Dr. A. M. Skeffington of Chicago, through his presentations has led me to a systematized method of case recording and the encouragement through that of a systematic case analysis.

III. Causes:

Utilizing the viewpoints of the above mentioned men, my next step was to attempt to analyze the several types of cases coming to me, and attempt to ascribe to each one of them, its particular cause of development.

I very soon began to feel that there were relatively few cases of hereditary myopia in my practice. Also, it became evident that most of the children began to notice this condition, a dimness of far point seeing, at the time of the fourth or fifth year of school, when near point tasks became heavier. Up until that time, the history showed that they had normal sight. The young office worker, as I have stated previously, first noticed this disturbance in far point seeing, inside of the first three months after a change of occupation, which new occupation demanded severe near point application.

In checking over the visual problems of each of these cases, I found that they presented one, or a combination of two or more, of the same type of visual problems we find in hyperopes, or any other type of refractive error. These were as follows:

A. Low amplitude of convergence, or convergence fatiguing before accommodation.

B. Low amplitude of accommodation, or accommodation fatiguing before convergence.

C. Inadequate, or improper lighting.

D. Disturbances in bodily function or metabolism, which in most cases, seem to resolve into a disfunction of the ductless glands. With this latter type we have been able to get little results, in attempting to cooperate with the general physician, due to the fact that treatment of the ductless glands is still a controversial subject among medical men, and as yet the results are rather problematic.

In cases which I considered convergence problems, my treatment was on the basis of the following reasoning:

The early fatigue demanded a greater concentration of attention on this fatiguing function, resulting in a greater stimulation or urge to accomplish the act of turning the eyes in at the object on which they were fixed, a corresponding action occurred in accommodation due to the habit relationship of function. This demanded a change in visual habits which lasted until the patient realized the futility of the effort and allowed the accommodative function to be over-stimulated for distance seeing, in order that a somewhat satisfactory compromise could be made for the near point demands, which demands are more necessary to meet because of a bread and butter incentive. The early signs of this struggle are frequently recited by the patient telling me, that for a long time before things at a distance were constantly blurred, he had experienced a period of blurred distant vision when he first looked up from his near work. Usually they express this in these terms: "After doing a lot of close work, I find that I have to focus my eyes for a little while before I can see clearly at a distance." These patients report that this period of "re-focussing" took longer and longer until finally they saw dimly at a distance all the time. School children complain of it with blackboard work. Office workers complain of not being able to see clearly around the office during that period of readaptation.

In this type of case, I build convergence and the visual problem clears up. I will deal with this more in detail under case handling, because with a reserve amplitude of convergence present, the accommodation functions normally.

In cases where I considered a low amplitude of accommodation a contributing factor, I reasoned that with a low amplitude of accommodation, the individual had little reserve accommodation left, and because of the constant use of those low reserves, the accommodative mechanism finally became set, or fixed in this condition of contraction needed for near use, and found it was easier to maintain that type of function, building yellow connective tissue as rapidly as possible, in order to lessen the demand, which has as its basis, the same bread and butter impetus.

In handling this type of case, I build accommodative amplitude reserves. I have come to believe that this type of case has associated with it, in most cases, esophoria at near, or both far and near, and, in all cases, if not that, a low physiological exophoria. So frequently has this

appeared, that I feel that this esophoria has the same reflex significance in a low amplitude of accommodation case, as the hypertonicity of accommodation, and the resultant apparent myopia, has in a case of low convergence amplitudes.

As I have stated before, there can be combinations present in one case, where the amplitudes were low in both accommodation and convergence. In this type of case, I have had some success in building both functions, but usually this type of case presents a general systemic problem, which may be the cause of the general exhaustion. In those cases where results have been realized, it would seem reasonable to assume the general systemic disturbance, had as its basic cause, the visual problem, and, reasoning in the same way, those cases that did not respond, had as the basic cause of the visual problem, the systemic condition. Assuming, of course, that these latter cases have been handled as intelligently as the others.

I have not found any cases where lighting, in and of itself, is the isolated cause of myopia, nor have I had any cases where the correction of the lighting problem was indicated as the sole method of treatment. This factor, along with systemic disturbances, seems to be associated with low amplitudes in either one, or both, of accommodation and convergence. However, poor lighting might be a contributing cause in the development of these fatigues in accommodation and convergence. I have never been able to check that through. As I understand it, Dr. Luckiesh blames these visual disturbances to the use of the eyes under poor lighting conditions, which of course, opens an entirely new field—that of visual hygiene in eye use. Naturally, in order to arrive at any conclusions, it would be necessary to have two groups of children, with at least 40 children in each group; one group doing all of their eye work under the ordinary lighting of today, and the other group performing all of their visual tasks under ideal lighting. It would be necessary, then, to determine the percentages in each group that manifest myopia, and the associated accommodative and convergence fatigues. I do not have the facilities to do this work, and do not know, nor have I any idea, what the results would be.

Much of our present-day myopia is due to an attempt on our part to adapt our visual apparatus to the modern near-point demands, and the very appearance of this myopia proves how poorly it can be done without help. Our job, as optometrists, then, is to visually adapt our patients to modern visual demands.

These myopic cases are not accepted primarily on the basis of reducing near-sightedness, even though that is the frequent result. The prime purpose is to make these people visually efficient in order that they may more efficiently take care of their jobs in life.

III. Case Diagnosis and Handling:

I hope it is clearly understood that there is no attempt being made to advocate any particular procedure in handling or diagnosing any case;

that I am outlining merely the barest basis of an analysis, not for the purpose of demonstrating how it is done, but merely to illustrate what I am doing in these cases. Criticism might be made for not including further data. This criticism is not justifiable in this particular paper because of its particular purpose.

Whether or not I am justified in interpreting my findings as I do is also beside the point, because in a private practice, results and patient comfort are the two requisites, not academic justification of reasoning. Had I had four months instead of three days to prepare this paper, it could have been much more complete. On that basis, therefore, I will proceed:

A. Convergence:

1. Direct light pupillary reflex. Where that does not hold a minimum of thirty seconds, using as a light source, retinoscope or transilluminator, general systemic resistance is considered low, and all of these cases have in conjunction with any other care given them, syntonic prescription N/L Alpha Omega.
2. Phorias. These can demonstrate a high physiological exophoria, esophoria at near, or, at both far and near. Where the fatigue is encountered in an early stage, we frequently find esophoria and a low physiological exophoria. In cases of longer duration, and by the way, the age of the patient seems to have relatively little bearing on these, there is a fairly high physiological exophoria, and those of still longer duration have a far point exophoria of from three to four degrees and a high physiological exophoria. These phoria findings do not of themselves, indicate the presence or absence of a low convergence amplitude, but do have a very significant bearing on the treatment. Those earlier stages will not stand as radical treatment as those cases of longer standing.
3. Dynamic Skiametry at 20 inches. Where this does not have a resultant lag of approximately three quarters of a dioptre, after deductions are made, considering the near point exophoria, it is considered an indication of a possible low convergence amplitude.
4. Distant Blur Out. In making this investigation, we use the smallest type legible to the patient at 20 feet. Place base out prisms in front of the patient's correction, until he reports that these letters are no longer legible. I have found that cases showing a reading of more than ten prism dioptres, are convergence problems, which have definitely started to affect ocular coordination at the far point.
5. Out Duction. Where this finding is greater than seven or eight prism dioptres, it is a possible added sign, showing that convergence is a problem in far point seeing.
6. The unfused cross cylinder and its resultant phoria, gives me a picture of what the two functions, accommodation and converg-

ence, will do when they are more or less allowed to function as they desire. A relatively high exophoria signifies an early convergence fatigue.

7. The base-out, blur-out at near. This is considered in its relationship to the base-in-blur-out and the test is made, using as a target the reduced Snellen letters, originally suggested by Jaques, and, unless the patient is fixing on the smallest letters legible at 16 inches, the findings have no significance of which I am aware. Rotary prisms are placed before the prescription and the base out prism is increased in amount until this one line of letters is no longer legible. Where this finding is less in amount than the base-in blur-out, it is a sign that negative relative accommodation amplitude is low.

8. Plus lens to blur out. This finding is taken with the same instrumentation and the same set up as the previous test, the only difference being, that plus lenses are added in front of the prescription instead of base-out prisms. This finding is comparable as to significance with the minus lens blur out, and where it is less in amount than that finding, by from three-quarters of a dioptre to a dioptre, it is a sign of low convergence reserves at near. Where such a finding occurs, the treatment indicated is binocular flasher treatment with plus lenses.

In those cases where eye movements are jerky or restricted, motility exercises on the Myoculator or Squint Korrector are indicated. Where near point fixation ability is defective, Syntonics, N/L Delta, are indicated, and where all reserves are low, N/L Alpha Delta for men, and N/L Alpha Upsilon for women. Where the far point blur out is high in amount, base out prisms are added to the plus lenses. When this is done a constant check must be made to be sure that the accommodative amplitudes are not reduced. If this occurs, such treatment must be stopped, or must be alternated with treatments to build accommodative amplitude reserves.

Where stereopsis is absent or defective, telebinocular treatments are indicated. Some type of binocular synchronizer is of material assistance in all of these cases. The one developed by Dr. Parkins in his research work has proven most effective, particularly where esophoria is present either at far on near, or both, or a low physiological exophoria is present.

I have failed to find where any one technique brings universal results, and, in many cases, everyone of these procedures are used. In a private practice, patients' and practitioners' time is valuable, and the quickest results, with maximum benefits are so necessary that it is impractical to experiment as to what results can be attained through the exclusive use of one technique.

B. Accommodation:

1. Phorias. This condition usually shows a low physiological exophoria and esophoria. However, cases of long standing going into a condition of fatigue will frequently show exophoria and a high physiological exophoria.
2. Dynamic Skiametry. This type will show a high lag.
3. Distance Blur-out. On the basis of this finding, I rely considerably on whether or not the case is primarily a convergence or accommodative problem. For example: If the phoria showed a high physiological exophoria, and the distance blur-out, instead of being seven, was three or four, then it would tend to signify to me that this was an accommodative fatigue as a prime trouble, and that the high phoria was a sign of exhaustion. When such a finding is manifest, and other tests substantiate the diagnosis of an exhaustion exophoria, syntonic prescriptions L or N/L Omega —D, and Delta Omega are indicated.
4. Out Ductions. Where this finding is less than seven, it is an indication of accommodative stress. However, in all cases, it is only a supportive finding.
5. Fused Cross Cylinder and its resultant phoria. In accommodative fatigue cases, the cross cylinder finding is high and usually is quite comparable to the dynamic skiametry findings. I find in practice that in the normal comfortable case, a plus fifty Add should result in a three degree increase in the exophoria. The fused cross cylinder finding is made at 16 inches with minus 25 plus 50 cross cylinder in front of each eye. When this finding is completed, the cross cylinders are removed, the patient's attention is directed to the reduced Snellen letter chart, vertical diplopia is created, and the phoria determined, while the patient is fixing the smallest readable letters.
6. Base-in-Blur-out at near. The same procedure is followed as in the base-out-blur-out, at near, the only difference being that the prisms are placed base in, in front of the prescription. Where this finding is three or four more degrees less in amount than the base-out-blur-out, it is a sign of accommodative fatigue. It is compared with base-out-blur-out for its significance.
7. The minus lens blur out at near. The same technique is used as with the plus lens blur out, the interpretation is: A high acceptance of plus and a low acceptance of minus is a sign of low reserve of negative relative divergence which is a frequent associate of accommodative fatigue.
8. Amplitude of Accommodation. This is taken in two ways, and in both cases monocular findings are made. The 20/30 or 20/40 line on the reduced Snellen chart is used for fixation and the card is drawn closer to the eyes until finally blur-out is reported. In the other method of determining amplitude, I place minus

lens in front of the prescription, the same target being fixed at 16 inches as in the other near point tests, and the minus lenses increased until the patient reports inability to longer read this 20/30 line of letters. These two findings are taken in each case; the near point of accommodation seems to indicate approximately one to two dioptres of amplitude more than by the minus lens method.

Whether it is typical of my practice alone or not, I don't know, but I find a surprisingly large number of young myopes where this amplitude of accommodation will be as low as three or four dioptres.

Syntonic prescription N/L Mu is indicated along with Monocular minus lens Flasher treatments, minus lenses of approximately half the amplitude, being placed before the eyes during treatment. Under this type of treatment, the amplitude will usually come up very rapidly.

When the amplitude of accommodation finding is sufficiently high to take care of the patient's needs, but the other signs of accommodative fatigue are present, minus lenses with the Flasher type technique, both eyes being used at the same time, often prove beneficial. However, I have realized greater success in prescribing bifocals in this type of case.

As I have observed before, there are relatively few of this latter type case in my practice. Most of them demonstrate a low amplitude of reserves.

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SOME NOTES ON VISUAL SURVEYS AND THE RELATIVE DISTRIBUTION OF CASES WITH SUBNORMAL VISUAL ACUITY

The present inquiry into the relative distribution of cases with subnormal visual acuity appears to the writer to be necessary on account of the paucity of available American data on this subject. As optometrists we are naturally interested in this subject, yet the statistical material developed in our own refracting rooms is not acceptable in this type of a study inasmuch as we are working on only those patients whose visual problems are such as to make them seek the services of a professional man for relief and therefore a large percentage of the public who are suffering from either no visual symptoms or from such symptoms as they can overlook are not taken into account when the statistics of the refracting room are compiled. To therefore gather material on the subject of subnormal vision it was necessary to turn to those visual surveys which had been made on large blocks of the public, either in industry, in schools or at large public gatherings where many persons had willingly submitted themselves and had undergone some sort of a visual survey, done at the hands of persons competent to valuate this type of thing. Despite the importance of this work, but little of real

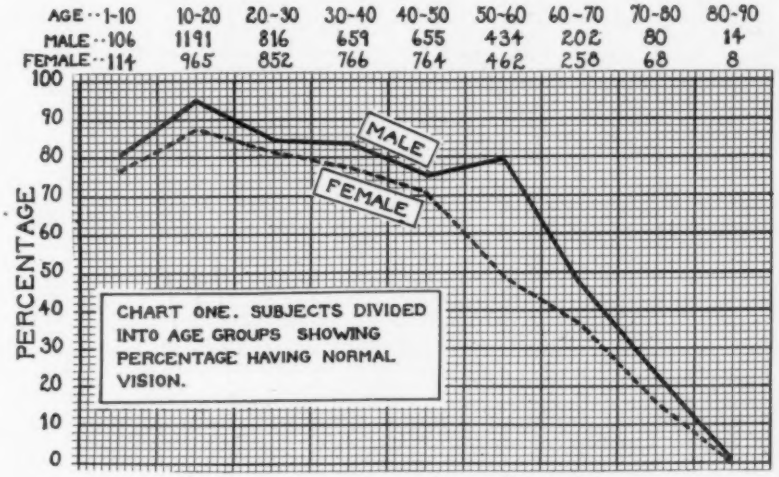
value has been done here. A careful study of optometric literature and the literature of allied professions reveals but few instances where work of real merit has been done. Many brief surveys have been made but the methods employed have been so hastily prepared and the results so carelessly compiled that the results are of little or no value. These latter surveys have been ignored in this study and only those surveys, the reports of which indicate that they were made with care and under proper supervision are considered. Fortunately, enough good work has been done to make a start in a study of this kind, but it at once becomes obvious that much additional work could and should be done by organized optometry to fully develop the data now lacking and now much needed.

In a study of this kind the question of visual acuity is naturally accompanied by that of age and sex. To be of value all of the statistical material should be broken down to show the exact numbers of subjects in each group of age levels and in each of the two sex groups. Such a study of visual acuity at once gives a picture of the entire ocular problem which then resolves itself into a study of the various factors producing subnormal vision which in turn would produce material of importance to our educators as it would indicate exactly where emphasis must be placed in the clinical development of the optometrists of the future as this sort of a statistical study would indicate just what problems the optometrists of the future would be facing to improve the visual status of their patients. This entire study is beyond the limits of this short report but indicates the need for much careful work in this field and indicates also the great need for much of the basic work, *i.e.*, the general visual survey, made under controlled conditions and under careful supervision so as to develop a general background of factual information upon which all future statistical work could be based.

A recent survey of this kind was conducted by the California State Optometric Association working in conjunction with the Western Institute of Light and Vision. This survey was made at the Los Angeles County Fair and some 8,414 persons were given certain visual tests under the supervision of optometrists. Each of these tests were made with as many of the variables eliminated as possible. Each subject was subjected to each of the following five visual tests: (1) visual acuity, (2) color vision, (3) ability to estimate distance, (4) binocular coordination and (5) horizontal visual field plotting. In addition to these visual tests each subject was also asked to select a level of illumination or the quantity of illumination which seemed to him or her to be easiest to read with. This last feature of the survey was done with controlled variable lamps under the supervision of illuminating engineers.

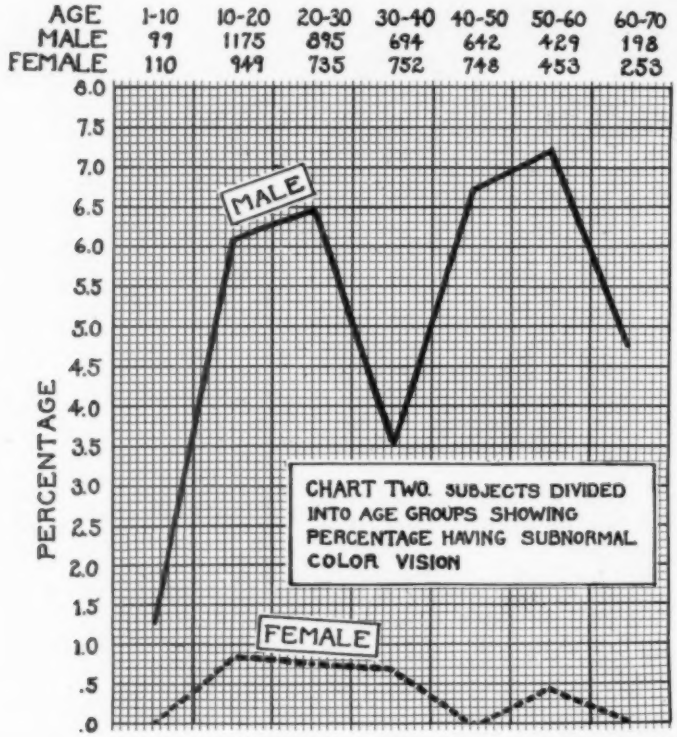
The equipment used in this survey work was as follows: for taking visual acuity a Projector-chart and screen was used in a room suitable for this purpose. The color test was made on all subjects in two ways (1) the Ishihara test first and (2) next a luminous miniature Traffic

Signal lantern. Testing the subject's ability to estimate distance was done with the Dolman or Standard Army Aviation Test. Binocular co-ordination was obtained by using the red glass diplopia test while the horizontal fields were plotted on perimeters using constant illumination and 5 degree test objects. 4,157 men and boys took these tests and 4,257 women and girls were also given them.[1] Chart one illustrates the percentage of each group having normal vision, the entire number of subjects being divided into nine age groups starting from those under ten years of age and running to those over eighty years of age, each group being limited to ten years. In Chart One, the second and third



rows of figures at the top of the chart indicate the number of subjects of each sex group, at each age level, taking the test. The findings of this test for distance acuity of vision indicate that the male group have slightly higher levels of visual acuity than do the female. Chart One indicates also that maximum visual acuity is reached during the period of life between ten and twenty years of age. The Chart indicates also that visual acuity drops but slightly from twenty years of age until forty has been reached, but after forty there is a decided decline in the subject's ability to distinguish detail at infinity. While these facts have been generally recognized in the past we have had no specific factual information on which to prove the point should it be raised. This visual survey here referred to is the first large survey containing subjects in large numbers in all of the age levels, and being conducted under controlled conditions, which now enables us as optometrists to give concrete evidence on this important subject of uncorrected distance visual acuity. The mass of data compiled by those making this visual survey

have placed all optometry under obligation to this California group as they have given us material of real value and have supplied our profession with a survey technique which will serve as a basis for further work in this field.



Charts Two and Three, while not dealing with visual acuity, cover several of the other aspects of the survey conducted by the California optometric group at Los Angeles. Chart Two shows in percentage form the number of subjects in each age group having subnormal color vision. Here is brought out in a striking way the large percentage of males having poor judgment of color in comparison to the small percentage of females suffering from this visual abnormality. This chart substantiates the statement made last fall by Professor Miles A. Tinker,[12] who in a lecture before the Minnesota Academy of Optometry on Color Vision said their findings indicated a much larger percentage of men were color deficient than were heretofore suspected. The Kogan-Bernstein[10] findings also are in agreement with those of the California optometric group inasmuch as he found in a mixed group of subjects, all

of whom were adults, that out of 1,777 persons examined that 5.6% had defects of color perception. The Kogan-Bernstein group of subjects was a selected group, all of them being railway employees and therefore his study on such a group should produce even lower averages than tests run on non-selected subjects. Here too is a field for much additional study and much additional research. The writer is now working on a series of investigations dealing with the related subjects of color education and color vision the results of which will be published next fall.

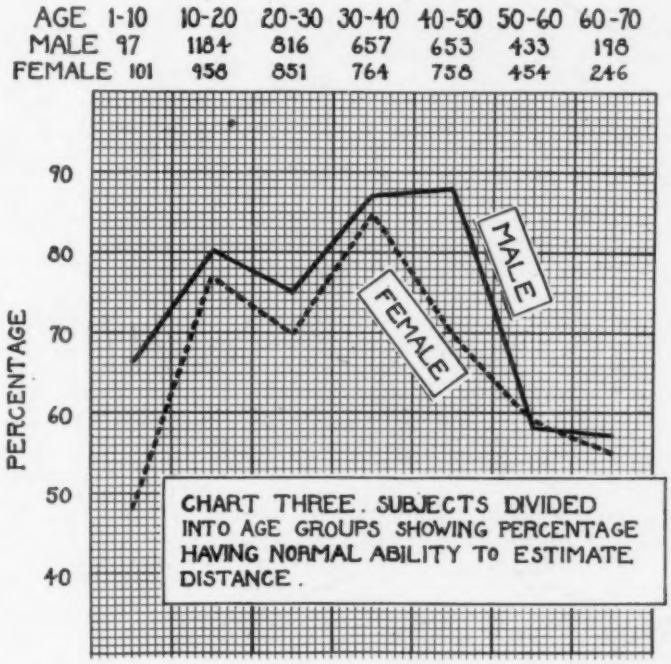


CHART THREE. SUBJECTS DIVIDED INTO AGE GROUPS SHOWING PERCENTAGE HAVING NORMAL ABILITY TO ESTIMATE DISTANCE.

In this entire field we have too little exact information. Too much is taken for granted and too much reliance has been placed on certain hypothesis developed years ago and never really studied. For this reason workers doing research work in visual survey clinics will add much to our knowledge of things ocular, and should be given all of the encouragement possible by organized optometry. Chart Three deals with the subject's ability to estimate distance. Here as in the two previous charts, the subjects are divided into groups by both age and sex and the findings indicate that almost 40 per cent of the subjects failed to pass the tests. With about one-half of our adult population driving motor cars this therefore becomes something to which we should give

our attention. Here, too, the California optometric group have opened the way to further work which should be carried on carefully before final conclusions can be drawn as this work is too new to the survey field to be assayed by the result of a single survey carried on in the manner done at Los Angeles.

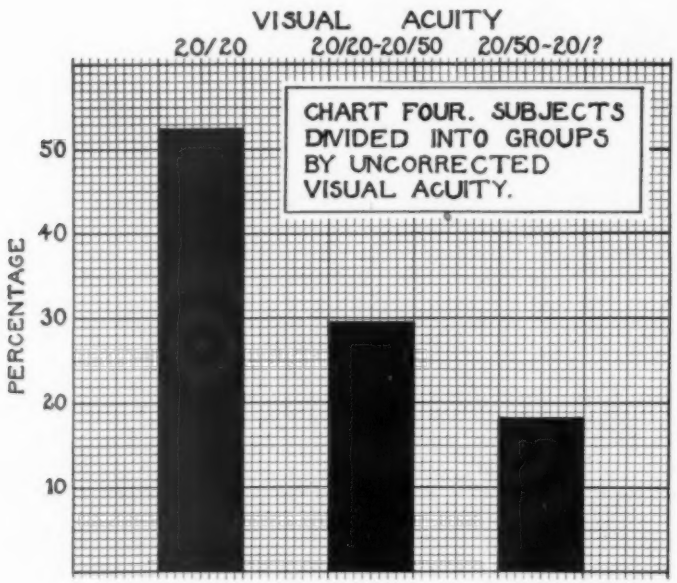
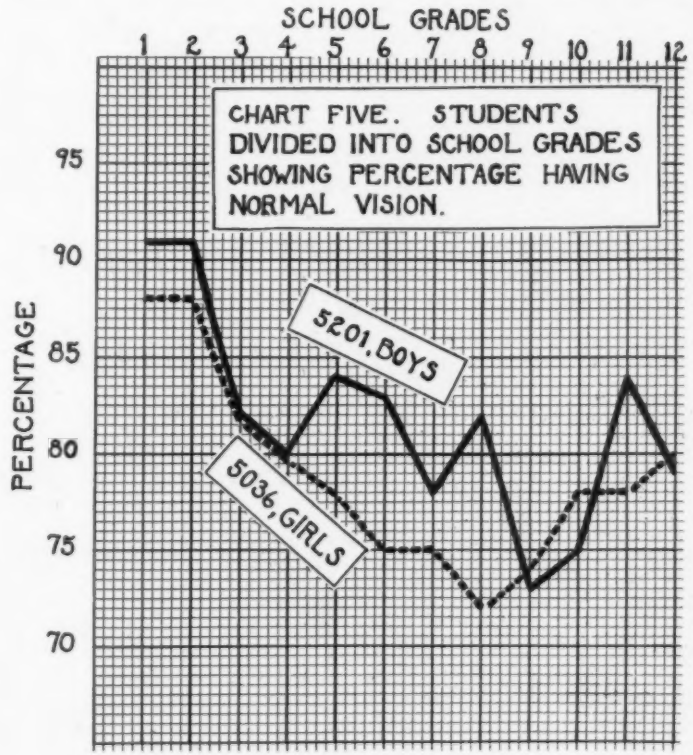


Chart Four deals with the uncorrected visual acuity tests made on 1,000 students as they entered the University of Minnesota. These students were divided into three groups by their ability to pass a Snellen test. (1) Students with 20/20 or normal vision. (2) Students whose visual acuity was between 20/24 and 20/50, and (3) students whose visual acuity was 20/50 or less. Boynton[2] found in making this survey that 52.4 per cent of the entering students had 20/20 or normal vision, 29.4 per cent were in the second group having an uncorrected visual acuity of from 20/24 to 20/50, while 18.2 per cent had an uncorrected visual acuity of from 20/50 or less, these being in the third group. Here, in an age group, running from 16 to 20 years of age, we find only 52.4 per cent of these young people having normal vision.

This is a somewhat smaller percentage of subjects having normal vision than was found by the California optometric group in the same age levels, but being a selected group of subjects, all having done considerable near-point work in the years just prior to taking the test the findings may be accepted as normal for these age levels taking into con-

sideration that all of these subjects examined by Boynton were students. It is interesting also to find that these same students experienced a loss of visual acuity of 5.7 per cent after four years of college work. In other words, four years of college work reduced the average level of uncorrected distance visual acuity 5.7 per cent.

Peckham[3] examined some 10,237 students. Of these 5,201 were boys and 5,036 were girls. These he divided into twelve grades as he found them in the Public School system of Detroit. Chart Five illustrates on a percentage basis the uncorrected visual acuity of these students. The chart shows here, as it did with the California group in Chart One, that the boys averaged slightly better than the girls. In Peckham's survey vision had to be under 20/30 to be considered subnormal, in other

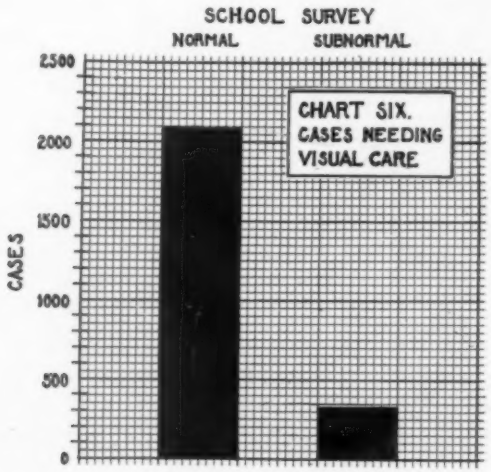


words, for instance, 82 per cent of the male 8th grade students had a visual acuity of 20/30 or better. This figure compares favorably with that of Petry.[7] It must be remembered, however, that this does not mean that 82 per cent of the 8th grade students of Detroit have normal

eyes. It merely means that 82 per cent of these 8th grade students have the ability to read 20/30 or better in making the Snellen visual acuity test. Obviously all of the hyperopic students from 0.50 diopter to 2.00 diopters are included in this normal group as they can, under all likelihood read at least to the 20/20 line. This portion of Peckham's work has to do only with visual acuity. Peckham's complete survey covered many additional points but as the complete findings have been published in this *Journal* I shall not repeat them at this time.

It is interesting to compare the findings of the visual survey made by Peckham in Detroit, Michigan, with those of Johnson,[4] made in Eveleth, Minnesota. To be sure, Peckham's survey covered many more students and had for its purpose a somewhat different background yet Peckham found some 21 per cent of the students suffering with a subnormal visual acuity of 20/30 or less, while Johnson, who was making his survey of the school children of Eveleth solely on the basis of correcting necessary visual defects found that out of some 2,500 students refracted, that 326 had visual defects of such nature that corrections should be prescribed. In other words, Johnson found that 12½ per cent of all of the students required corrections, and as he points out in his report, he prescribed corrections only to those students whose gross error of refraction approximated one diopter. Chart Six shows the relative distribution of cases needing refractive corrections based on the findings of Johnson, who in his work at Eveleth made a complete examination on each of the students.

In comparing the findings of the California optometric group with those of the college freshmen examined by Boynton, and the grade and high school students examined by Peckham and Johnson, using for



this comparison the first two age divisions of the California group, we find that in these first two age divisions the California group determines that approximately 10 per cent of the young people they examined had sub-normal vision. Boynton on the other hand, with a selected group of freshmen in her visual study, finds something like 47.6 per cent having sub-normal vision, while Peckham, taking a visual acuity of 20/30 for his normal level rather than 20/20 as did Boynton, finds in his somewhat younger age group that 21 per cent of these students had sub-normal vision. Johnson, on the other hand, using necessary correctable refractive error rather than visual acuity as his yard-stick, finds 12½ per cent of his students requiring visual care. These findings are somewhat at variance one with the other and indicate:

(1) That as there are several variables possible in this type of work, making it difficult to compare one visual survey of students with that of another.

(2) That until some sort of a systematic survey routine is established as was done in California, and adopted by all optometrists doing this work, the findings will continue to be at variance and therefore difficult to appraise properly.

(3) That many additional surveys of students' vision be made. Figures to be absolutely trustworthy must come from all parts of the country for a statistical study of real importance should embrace at least 100,000 students.

(4) That future students examined be classified by age groups and by sex as was done in California, with a further break-down of the age levels.

(5) That in the four student investigations just mentioned that 16,103 young persons between the ages of 6 and 20 were examined, and of this number some 3,185 were found to have defective vision which resulted in reducing visual acuity to some point below normal. This amounts to 19.4 per cent of the total.

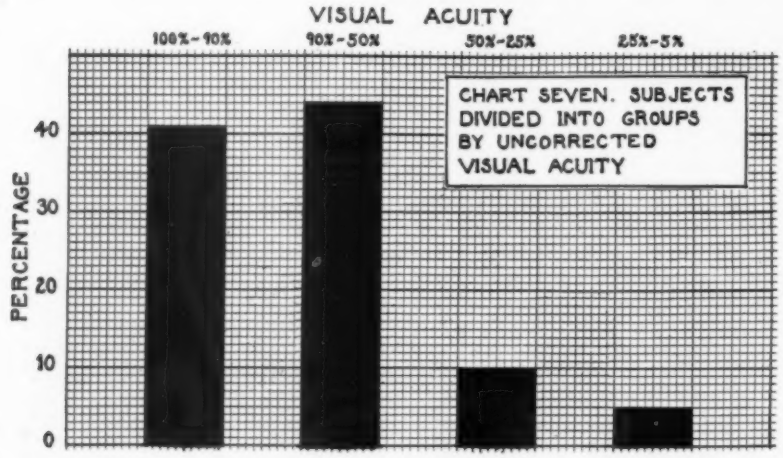
(6) That because of the fact that no two of these surveys were conducted in an exactly like manner, the writer recognizes the danger of compiling such an average.

(7) The work done by these independent investigations on the vision of students does prove that far too many of our student population are doing their school work with vision on some sub-normal level.

(8) That optometry as a profession must assume greater responsibility in this field and must arrange, through its professional societies that much visual care, now greatly needed, is supplied.

So much for the surveys in which young persons were largely examined. We will now turn our attention to work done in the field of adult examinations. Collison[5] reviews the survey made at the Canadian National Exhibition in which 1,093 persons were given a Snellen visual acuity test. Chart Seven shows the result of this visual survey. 449

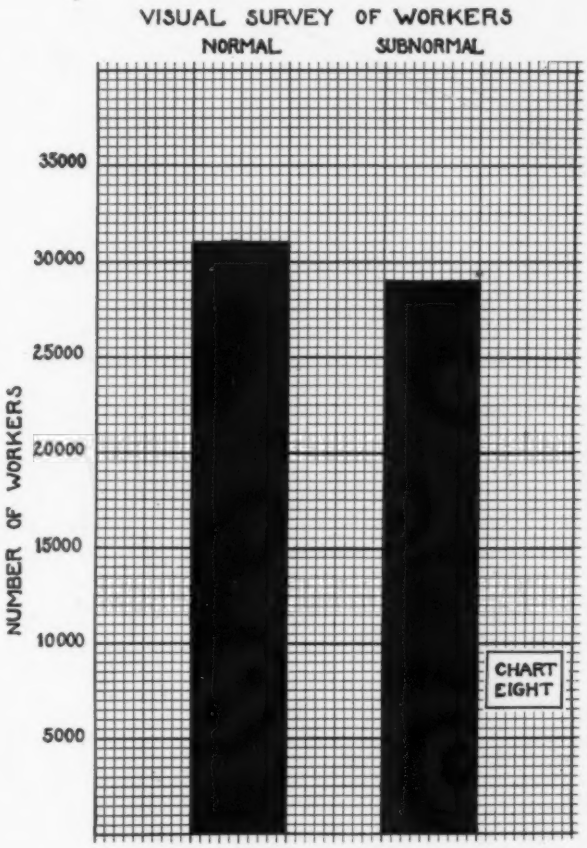
persons had a visual acuity of from 100 per cent to 90 per cent. These were considered normal from the standpoint of visual acuity. Of the total number examined this was but 41 per cent. 481 persons had a visual acuity of from 90 per cent to 50 per cent. This group embraced 44 per cent of the total. 109 persons had a visual acuity of from 50 per cent to 25 per cent. This group was 10 per cent of the total number of persons examined. The last group were those having sub-normal visual acuity of 25 per cent or less. There were 54 persons in this sub-



division or 5 per cent of the total. It is interesting to note here that but 41 per cent of the total had normal vision, a figure which compares somewhat favorably with the general average of the adult age levels of the California survey. It is also interesting to note that 85 per cent of the adults had a visual acuity in such visual levels so as to not materially interfere with their visual efficiency, despite the fact that more than one-half of these had somewhat less than 90 per cent visual acuity as measured by the Snellen tests.

These visual survey findings on adults are further developed by Swandon[6] who presents the figures taken of a visual survey of 60,000 workers in the automobile industry at Detroit. Chart Eight illustrates the division of these workers into two groups. First those whose visual acuity was normal and second those whose visual acuity was sub-normal. In the first group there were 31,000 workers. In the second there were 29,000. As is well known the average age level in this industry is from 20 to 50 years with the majority of workers found around the 30 year age level. Therefore at these age levels one finds nearly 50 per cent of these adult male workers having sub-normal vision. Swandon also presents the results of a visual survey of 2,000 workers in a textile mill. This group was divided into two sections,

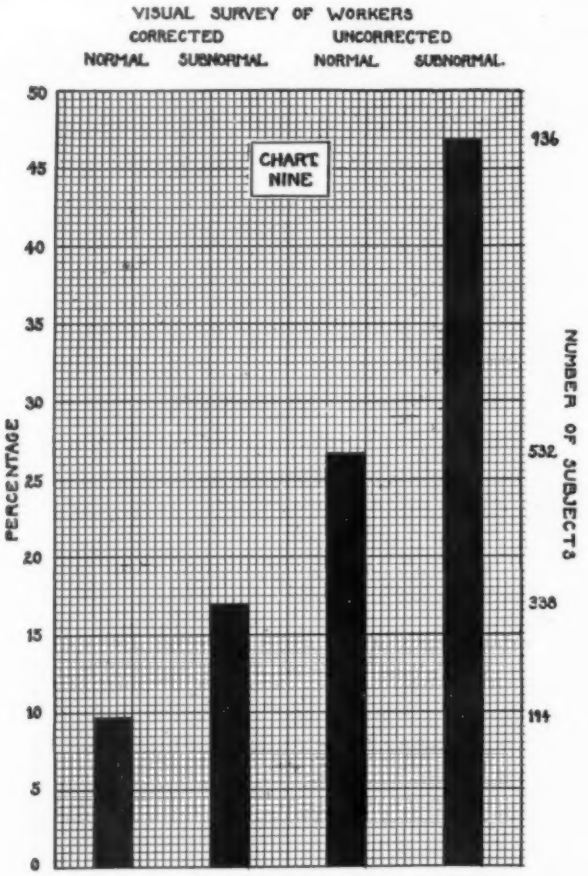
first, those already using corrections and second those not using corrections. In the first group it was found that only 40 per cent of those wearing corrections had these properly fitted. Chart Nine illustrates the result of this visual survey. Of the total number of weavers and others,



9.7 per cent of the workers were found to be wearing corrections which were satisfactory. 16.9 per cent of the workers were wearing corrections which were unsatisfactory. 26.6 per cent of the workers were using no corrections and had normal visual acuity, while 46.8 per cent of the workers were using no corrections but had sub-normal visual acuity. It is therefore evident from the results of this survey that some 73.4 per cent of the adult workers in this industry needed visual care.

Additional evidence of the general prevalence of sub-normal vision among adults is submitted by Doane[8] who in reporting on the opto-

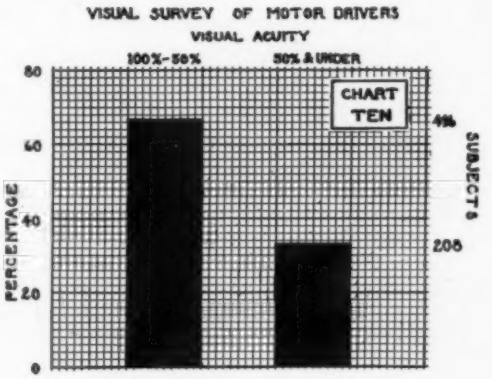
metric Visual Survey of Motor Drivers' Eyes at the New York State Fair at Syracuse finds that of 624 persons examined, that 208 had a general level of visual acuity of less than 50 per cent. As illustrated in Chart Ten this is just 33 1/3 per cent of the total, and from the standpoint of driving a motor car Doane thinks this lower one-third all unfit



to drive without first having their vision improved with corrections which materially raise the level of their visual acuity. In this Petry[7] and Dublin[9] agree. Of those examined in the Syracuse survey, 484 out of the 624 had sub-normal vision or approximately 66 per cent of the total number of adults submitting to this visual survey were found to have visual acuities of less than normal.

In comparing the findings of the California survey with the data presented by Collison, Swandon and Doane one finds that in the main,

these survey results agree. To be sure the last four surveys mentioned, *i.e.*, the Canadian National Exhibition, the automobile industrial visual survey, the textile mill survey and the Syracuse State Fair survey of Motor Drivers all report a somewhat greater percentage of sub-normal vision than does the California group but these last mentioned reports merely serve to emphasize the great need for additional work of this character. Not only does this type of visual survey work bring home forcibly to the public at large the need for proper care of their eyes but the profession needs also the data acquired by the workers at these survey points, providing the surveys are conducted in proper manner.



In the important work of making visual surveys on adult groups, be it at large public gatherings of people, or in industry or with specialized sections of the public as in the case of drivers of motor cars the same general rules apply as do in making surveys of the visual acuity of students. The data used in this short study of the relative distribution of sub-normal vision at various age levels, using the California optometric survey, and the others mentioned, indicate considerable variance in techniques of survey routines as well as in the statistical reporting of the findings. As one can see nearly every report uses a somewhat different approach to the problem and while all agree that a fairly large segment of our total population suffers from sub-normal vision the figures vary from around thirty per cent in the case of the California group to nearly fifty per cent in the last four surveys mentioned. In these last four surveys some 63,617 persons were examined. Of this number 32,121 were found to be normal while 31,496 were found to be sub-normal when considering only their visual acuity. As I have pointed out before this study does not deal with visual efficiency, but rather only with visual acuity. For a study dealing with visual efficiency much work of the character done by Aves[11] in England is needed and before that could be done with any degree of satisfaction, a survey technique would have to be agreed upon, in which as many of the variables as possible were eliminated and in which the data collected by the workers would be

constant at every point in which the survey was made. With the many large county and state fairs which are held throughout this country each fall, and with the many optometric societies in every state it seems that a very large number of controlled surveys could be conducted within the next few years by optometric survey teams. These teams filling out specially prepared charts giving not only visual acuity, but a number of other important ocular facts about the eyes and vision of the subjects examined. Such work would be of immense value to both the public and the profession and would be a stimulating factor to many of the graduate study groups of optometrists now meeting in many of our centers.

The facts already at hand indicate the magnitude of the problem. Surveys conducted during the past fifteen years point the way to more thorough work of this character which must be done by optometry as a profession if we are to justify our right to the title of guardians of the vision of the people. This sort of thing must be done by college trained optometrists who as visual scientists are serving their people and their profession to further safeguard vision and to place their profession in the firm position which can come only from a complete knowledge of the visual problems now facing the nation.

Carel C. Koch.

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ABSTRACTS

VISIBILITY OF VARIOUS TYPE FACES. Mathew Luckiesh and Frank K. Moss. Journal of Franklin Institute, January, 1937.

This is a report of an experiment carried out by the authors to determine the variation in visibility of various kinds of type faces. The authors present a table of the relative visibility of various eight point machine set monotypes. To equalize the visibility of the different kinds of type faces the illumination was increased or decreased as the case may be. For example it took only fourteen foot candle to see eight point Garamond Bold, while it took thirty-six foot candle to see equally clear Caslon Light Italic. It was concluded that the variations in visibility, expressed in terms of illumination, are quite significant in many cases. The authors found that six point type could be made as visible as twelve point type by increasing the illumination upon the smaller size three and one-half times that used upon the larger size. J. I. K.

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BOOK NOTICES

CONTROLLED READING. A CORRELATION OF DIAGNOSTIC, TEACHING AND CORRECTIVE TECHNIQUES. Earl A. Taylor, of the Bureau of Visual Science, The American Optical Company. Published by the University of Chicago Press, Chicago, Ill. 101 illustrations, 367 pages, cloth, $3.50. 1937.

Taylor is a familiar figure in optometric circles, and the new book just issued by him reflects, through the written word, the great fund of knowledge and experience he has gained throughout the past several years, in which he has spent much time working on the problem of reading both from the standpoint of speed, effectivity and of comfort. This new book written by him is a well put together hand book for the Ophthalm-O-Graph and for the Metron-O-Scope, and in addition, it is much more than this, as the author has included within its covers, much of the important material that has been developed in this specialized field during the past decade.

Part One is devoted to a review of some thirteen of the outstanding research workers in the field of eye-movement photography. Not so much a review of their lives, but rather a review of their work in this field and giving a complete bibliography of the writings of each, as these are pertinent to this subject. In this section the late Dr. E. B. Huey, of Johns Hopkins, is mentioned as is the now departed, but ever renowned French ophthalmologist, Dr. L. E. Javal. Among the others given this special mention are the following three scientists from the University of Chicago, Drs. Guy T. Buswell, W. S. Gray and C. H. Judd. From the Uni-

versity of Minnesota, Dr. Miles A. Tinker is mentioned and a list of his numerous writings is appended. From Columbia University three men are mentioned, Drs. J. McK. Cattell, A. I. Gates and E. L. Thorndike. Harvard contributes Dr. W. F. Dearborn. Carnegie, Dr. Raymond Dodge. The University of Texas, Dr. C. T. Gray, and the University of Pittsburgh, Dr. G. A. Yoakam. These thirteen scientists are the men whose work contributed much towards making the study conducted by the author possible and Taylor fittingly gives credit to these men in the first portion of this work. A full page plate of each is included.

Part Two is given over to a historical review of the early work done in the field of eye-movement photography. This is necessary as it is essential for the reader to grasp this fundamental background which is very important in a study of this kind. This section also deals with an account of the objective methods employed by the various investigators. Taylor also lists and illustrates the various types of apparatus used in these investigations and portions of the film reading-graphs they supervised making. The chapter ends with a description of the Ophthalm-O-Graph, a small clinical camera, now suitable for use in a study of the eye-movements of patients with either refractive defects or imbalances of the extra-ocular muscles which may be the cause of reading disorders.

Part Three deals with special problems which are met and which have to be solved in bringing forth a remedial reading development program. The Metron-O-Scope is here reviewed. This is an instrument used in treating patients who have been proved to be slow readers. The use of this instrument and the techniques which accompany it, do much to improve this defect.

Part Four deals with the various anatomical, neurological and physiological problems which confront the worker in this field. A series of very valuable comparative studies has been made by Taylor in his review of these factors and their effect on reading. The book closes with a very complete bibliography listing everything of importance written on this subject. Taylor has presented much of value in this hand-book which should serve as a valuable guide to the optometrist engaged in this new field of eye work. C. C. K.

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NURSING IN DISEASES OF THE EYE, EAR, NOSE AND THROAT. By members of the Staff of the Manhattan Eye, Ear, and Throat Hospital, New York City. Sixth Edition, 288 pages, 93 illustrations. Published by the W. B. Saunders Company, West Washington Square, Philadelphia, Pa. Cloth, $2.25. 1937.

It is a fact that as a group the women office assistants of optometrists are, in most cases at least, wholly without training in matters of ocular anatomy, physiology and refraction. Whatever knowledge they do possess of the eye and its surrounding tissues has been largely acquired

from observing the optometrist in his work. These girls can be made more efficient, and of much greater value to the optometrist, in the more intelligent handling of his patients, in both his refractive and orthoptic work, if their general background of ocular and optometric knowledge is enhanced. The small text book now under consideration is one which would assist in doing this, if carefully read by an office assistant, interested in improving the standard of her own work. The first half of this book deals with the eye, and every portion of ocular work is so covered that a person with no previous experience or training in ocular work, could understand and grasp the material as offered. The book is written for the student nurse, but will serve splendidly as a text for optometric office assistants and as such can be recommended for a place in the offices of optometrists. C. C. K.

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A HAND-BOOK OF OCULAR THERAPEUTICS. Sanford R. Gifford, M.A., M.D., F.A.C.S. Professor of Ophthalmology, Northwestern University Medical School, Chicago, Illinois. Second Edition. Published by Lea & Febiger, West Washington Square, Philadelphia, Penna. 60 illustrations. 341 pages. Cloth $3.75. 1937.

This is a second edition of a work which has won high praise from ophthalmologists because of the practical manner in which the subject has been presented. Optometrists too will find much material within its covers which will be of both interest and of value. To mention but a few of the chapters in which members of the optometric profession will enjoy reading we call attention to Chapter Five dealing with physical therapy in a very rational way; Chapter Fifteen in which the author discusses various disorders of the extra ocular muscles and gives some rather sound advice on the matter of orthoptics. Also the Appendix in which the subject of myopia is reviewed and commented on by Gifford. The book deals mainly with the treatment of ocular pathology but there is much good here as well, for all refractionists. C. C. K.

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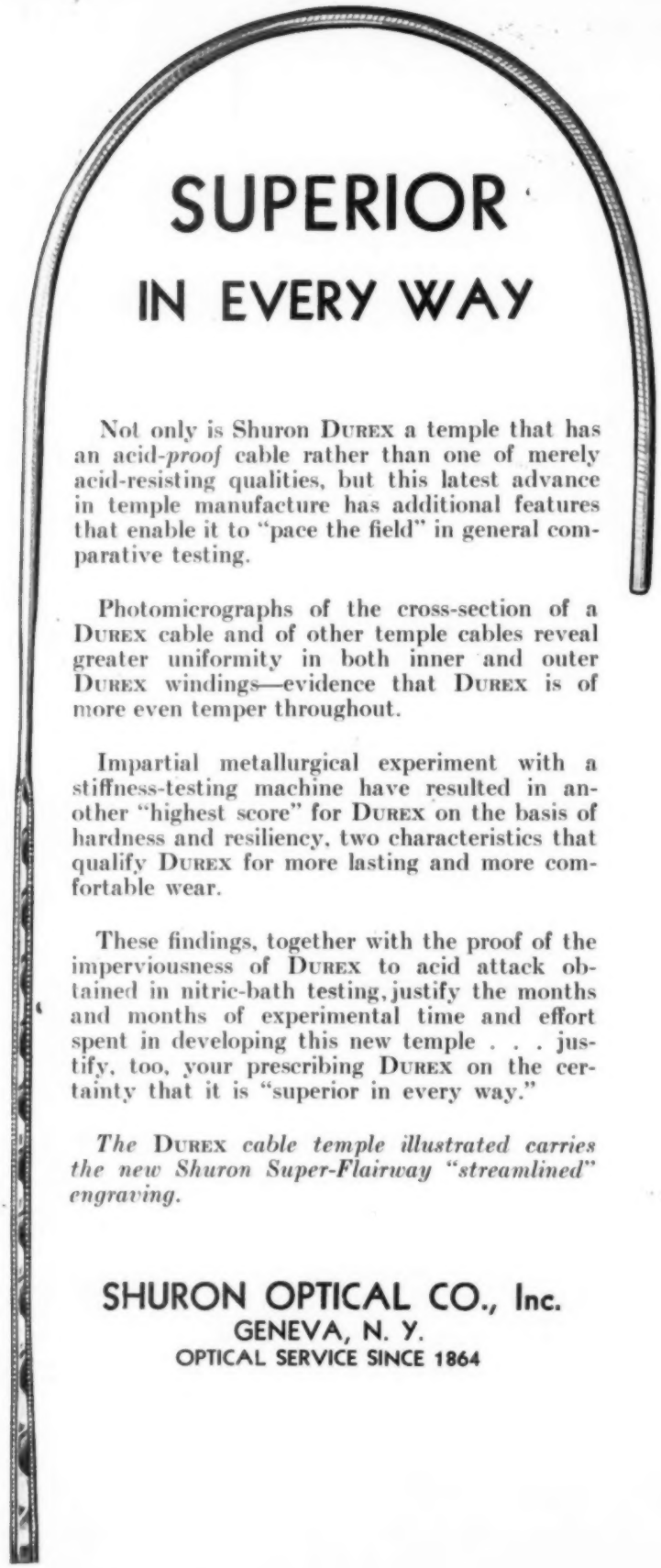

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